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THE WAR PSYCHONEURO-
SES AND COMPLEMENTARY
PHENOMENA.

BY

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BIOLOGICAL FACTORS OF THE WAR PSYCHONEUROSES AND COMPLEMENTARY PHENOMENA.

BY HOMER WAKEFIELD, M.D.,

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IN a recent article on war shock,^{37.1} we endeavored in a running commentary on some of the current literature on the subject to point out a few apparently neglected facts that seemed to have direct bearing on the live issues presented by the great war. It was, however, not until a monograph by Dr. Stewart Paton, entitled "Mobilizing the Brains of the Nation," was placed in our hands that we were brought to a full realization of the real demands of the occasion. This has led to the preparation of the present paper in an endeavor to supply as best we can the higher standard of biologic analysis and elucidation called for by Dr. Paton.

Did space permit we would like to quote his entire article, but we will suffice with the following as expressing the present situation and its demands upon Americans collectively to meet: "We cannot without sacrificing conditions essential for the preservation of personal and national sanity hide the fact that many of the attempts made to face the actual issues of life are at the best half-hearted efforts; while

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the recognition of critical situations or events is interfered with by the tendency to compensate for defects in perception by introducing a vague mysticism. . . We need to go to the root of the trouble and get accurate information as to the structure and function of the machine we are trying to operate. How do we expect to control temperament and character if we are ignorant or indifferent in regard to the nature of the biological mechanisms regulating temperament and character? . . It requires both courage and intelligence to face the fact that comparatively little is known of the laws governing human behavior, but when once the admission is made, then it is our first duty to accept the privilege of working hard to add as rapidly as possible to the present stock of information. . . The present catastrophe which threatens civilization is one of the tragic results of attempting to organize society in order to satisfy theoretical conceptions without taking cognizance of the fundamental laws that govern human nature. If we had been familiar with the biologic mechanisms controlling the personality, we might have been alive to the danger lurking in any conception of duty which carries with it the idea of 'special dispensation of Providence,' or missions to reform for which others are unfitted. . . Man has been so absorbed in trying to discuss life in abstract terms that he actually forgot to inform himself even as to the principal events taking place in the life of any one person in the effort to adjust successfully to meet the daily needs. . . Eventually, as the result of insisting upon the value of biologic methods in the analysis of all forms of social, national or racial activities, we should be less inclined to promise permanent peace until something more is known of the actual

conditions regulating the genesis of motives and impulses or limiting the sphere of voluntary control of actions."

The specific endeavor of the present paper is an elucidation of effects exhibited in the war neuroses, and especially to bring those elements usually classed within the domain of the *psychical*, as well as the neurological into an unbroken contiguity with the well-known phases of the *physical*, *biological* and *physiological* sciences. So long as ignorance or a vague perspective bedims the view, the clinical picture of all the war neuroses, including shell shock, and their interrelations will be obscured and the nature of the causative factors will be misinterpreted. So long as any human maladies are pronounced *psychical*, and as such metaphysical or non-physical, their pathology will be enveloped in vagaries, their therapy will languish for sustenance and victims of their derangements will become delinquents and public charges through neglect of proper treatment.

There is nothing mental which is not also physical. There is no *psychical* which is not the *physical* product of the somatic physical body. Sensation, the muscular sense, and all the five special senses are more or less highly specialized and complete organic functions which narrow the range of characters of the stimuli, to which they are reactions, as response phenomena of the inherent irritability, that vital character, more than any other, by virtue of which the primitive unicellular organism lives and has its being, as completely traceable by man. This property, irritability, we shall trace in its many elaborations in the phases now before us.

Even emotion, which is by some writers, of all human manifestations held most supernatural, is

most closely connected and allied to *physical* phenomena in general, and is *per se* the most clearly expressed as motor phenomena and by contractile phenomena of muscular and other less contractile tissues. As we have seen, the more violent and depressive emotions or paroxysms of the emotional allied phenomena, are spasmodic contractions or contractile constrictions which often deflect the major volume of the blood from the superficial to the deep (splanchnic venous) circulation.

The nomenclature of the subject is so vague and ill-defined that demarcation lines are difficult to draw, and moreover identities and definitions are especially unsatisfactory in addressing a paper to an unprepared reader. Emotion, now brought down to a physical basis, is yet more difficult to differentiate from hysteria, while the lesser emotions would not be characterized as hysterical. Hysterical paroxysms, short of epileptoid convulsions, are usually termed emotional and the question arises: where comes the line of demarcation between the superficial spasm of the emotional and the somatic tonic and succeeding clonic contractions of hysterical convulsions, and where is the line that marks the point of division between the epileptoid and the true epilepsy which it not infrequently develops into when successive repetitions as hysterical manifestations are not curbed in time to circumvent the operation of the law of repetition which provides that all physical actions are facilitated by previous actions of the same tenor, and are further facilitated corresponding to multiplicity of antecedent ones.

Repetition of emotions foster chronic emotionalism, and furthermore correspondingly lower the level of overflow, thus diminishing the height of attained head necessary to obtain vent through the

safety valve emission of cumulated physical motive force. In fact an individual may become so emotionalized and so emotionally weak that every trivial factor may produce an emotive emission.

Emotions of apparently diverse types are atypical apart from emotionalism, *per se*. For example religious emotions serve as well as any to promote an emotionalism which may be reexhibited as sexual emotion, dipsomania, or a paroxysm of fear or other form of neurosis at the battle front. On the other hand hetero-and homo-sexual excesses and vices or alcoholic addictions become productive of the chronic emotionalism, the effect of which, in general, is to lower the resistance, permitting emission at progressively lower and lower levels.

The medical problem is not only one of prevention of emotionalizing of men in training for the army and in the trenches but also of the returning war neurotics who are distinctly injured by any type of emotion, either profound, violent, depressive, or repeated. Emotion is in essence a spasmodic response phenomenon and its cultivation is an invitation to other expressions of the spasmodic dyscrasia. Spasmodic reactions become habitual.

Oppenheim²⁴ has recognized the importance of the vasomotor-wrought disturbances, but suggests that the painful neuritic symptoms point to a hypothetical wave of molecular changes in various parts of the nervous system as an impact resultant. This, however, has been rejected by several authors. He does not attempt to explain how such an effect on the nervous system would cause the observed vasomotor phenomena or how the terrific neuritic pains are benefited by hot baths, superheated air, etc., which he employs.

The Tissue Density Factor.—All writers on emo-

tionalism, hysteria, spasmodic manifestations, convulsions, shock, etc., as psycho-neurotic phenomena, recognize a common predisposing cause vaguely termed constitutional inferiority, congenital defect, neurotic constitution, the stigma of heredity, degeneration, defective development, etc. The question at once arises: what is the nature of this vague something of such prime importance, which, coming as accidents of constitution, of heredity, of birth and of development, is responsible for such a multiplicity of syndromes? It does not bear out anatomical conformity to the nervous system so there is no use in abstruse speculations as to the part played by the neurones, by the central nervous, or the sympathetic systems.

It is obvious that this predisposing cause is some specific unit physical condition which is in turn responsible for a typical action and effect which shall be compatible with those exhibited as prime etiological factors and consistent with the superimposed factors exhibited as ultimate exciting causes of the group of ultimate manifestations under consideration. This specific *physical* condition must be an actual one, confirmatory by proper investigations. Its alleged typical action must be subject to substantiation by recognized methods of observation, and so on through to the last analysis. Such a series of tests can be wholly satisfied only by the *tissue density factor*, and by the relation of tissue density to response phenomena.

Regardless of what angle we approach the subject the results of investigation are never disappointing. Wherever we find living tissue, whether in man or the lower animals, the state of tissue esthesia corresponds with its state of density. In man, in all divisions of sex, age, race, health and disease,

the tissue density corresponds with the exhibited sensibility attributes. In induced conditions the tissue density falls as deviations from the normal are induced. Development of growth is one from a lower to a higher density, and arrested development carries with it a correspondingly lower tissue density. All tissue reversions to or toward the embryonic form (atavism) revert to a correspondingly lower tissue density. Thus atavism has come to be recognized as a cause of stigmatic phenomena.

Sunstroke, so called, or more properly heat-stroke, is a typical example of reduction of tissue density by heat, often in persons previously free from neuroses in which are thus produced hyperesthesia and the several stigmata of the hysteric and the neurotic. Americans resident in the Philippines experience increasing hyperesthesia which becomes so great by the third year that they must leave the tropics or suffer irreparable deterioration. High surface heat in its effects on peripheral tissue density and in its production of hyperesthesia of the superficial tissues is thus productive of supersusceptibility to cold and to spasmodic reactions to chill attended by the characteristic overt recoils of the susceptibility wrought in neuropathogenics. Continuous hot baths also have the unfortunate ultimate effect of augmenting hyperesthesia—the prime factor of neurotic and other spasmodic affections.

The systematization of hysterical manifestations in accord with the common muscle associations of daily life functions, rather than of unit nerve distributions, evinces the influences of the law of reaction repetition, automatism and fatigue influences upon their esthesias which are inseparable from their sense memories which the psychical theorists admit as such an important factor.

The "jumpiness" of the war neurosis is caused by characteristic systemic tics which are typical of the sudden starts of fright from which they take form as habit or repetition phenomena. They may be characterized as memory manifestations. They are easiest cured by the earliest treatment, by the eradication of the underlying hyperesthesia.

The Physical Bases of the War Neuroses.—It must be obvious to all unprejudiced investigators that no unit pathological lesion can be broad enough to blanket the extremes of war hysteria on the one hand and war shock on the other. They have, however, some common factors. Depressing and intensive emotions, apart from concussions and shock, exhibit corresponding indications of spasmodic circulatory deflections, approximately evacuating the periphery and extremities and coincidentally engorging and producing stasis of the major trunks, and lesser splanchnic veins. In cases of shock and collapse, this circulatory condition is more pronounced and approaches yet nearer the typical status of death. Both the hysterical and the shock cases thus have a *physical* basis, but only the latter may be said to exhibit organic damage. It is truly a paradox of pathophysiological nomenclature that the obvious super-irritability (overt reaction) manifestations of the paranchymatous tissues are so universally dominated *nervous* phenomena and that just as obvious manifestations of *organic* damage to the nervous structures are so often dubbed *psychic* in nature. Such are the current interpretations of war hysteria and war shocks. True, there are also exhibited all gradations of transition between the above named extremes, and shocks frequently are engrafted upon hysterical foundations, resulting in all degrees of relative proportions of the two elements.

Strumpell gave us his concept of that vague sense of irritable weakness, of chronic perturbation, ferment and restlessness which goes by the misnomer *nervousness* when he wrote⁴² "What is called nervousness, is, from a scientific point of view, above all a spiritual and not a corporeal disposition." Since science knows not the term *spiritual*, and has never attempted to analyze or define it, we must interpret his use of it as meaning *psychic*, in the non-corporeal sense. It is, however, significant as an admission by this great authority on the nervous system that while he is willing to relegate it to the domain of mysticism, he nevertheless disowns it as of actual *nervous* origin.

Since we now propose to place the *psychical* within the range of the physical or corporeal we hope there will be no occasion in the future for the induction into scientific nomenclature of the word *spiritual*. We may then refer to mental and non-mental functions of the physical body without fear of confusion of interpretation.

Nervousness, so called, is the most common manifestation of somatic hyperesthesia. We referred in a former monograph^{37.1} to Kennedy's paper entitled: "Nature of Nervousness in Soldiers". While usually associated with emotional instability, they should have distinctive differential interpretations in order to avoid confusion and misconception. Let us allude to the *hyperesthesia* of soldiers for the sake of a more universal and definite nomenclature.

If we differentiate the neuroses into sthenic and asthenic, we thereby provide a basis of identification and discrimination. Both are hyperesthetic states and both are characterized by weakness, but the former much less than the latter. In these the physical strength varies in as wide a range as that between

the high grade moron and the feeble minded. The sthenic, the well nourished but sedentary and soft individual, attains the highest degree of tensional stress or excitement, culminating in the highest degree of explosive violence of outburst or overflow. He is the highest strung hysteric. Conversely the asthenic is the typical neurasthenic. Between these two extremes we have all gradations of transitional phases. All characterized by irritability and weakness. The sthenic type manifests its physical motive force in the explosive violence of its outbursts rather than by the enduring strength exhibited by sustained effort. On the other hand the asthenic phase is characterized by great weakness which permits no accrument of energy of kinetic value prior to its emission in the lowest form of sterile emotion. Perturbation produces exhaustion after imperceptible recoil responses. Both of these extremes and all intermediate states demand rehabilitation of tissue integrity, but the first may begin with graduated active exercises while the latter must begin with passive massage, manipulations and exercises cautiously interspersed with rest; the physical treatment never passing the fatigue limit, nor the rest-full recuperation. The work cure, however, is in general preferable to the rest cure.

Having already in a recent paper^{37.1} discussed in considerable detail the fundamental biological reactions as aggravated by stigmatic hyperesthesia and the duplex common physical factor of spasmodic blood deflections from the superficial to the deep circulation, and from the peripheral capillaries to the splanchnic venous reservoirs, resulting in serious venous stasic and circulatory disequilibrium, we will pass on to other complementary phenomena.

Hyperesthesia.—It is not with a view of merely

correcting or improving the nomenclature that we are striving for the recognition of the physical basis of so-called purely psychic phenomena of the neuroses, but rather of the establishing of a sound basis of co-ordinated theory and treatment. At the outset both sides of this discussion admit that these so-called *neuroses* are not typically *nervous* functional irregularities. Charcot demonstrated the freedom of the nerves, cord, and brain from any related enduring lesion, in his famous lectures of 1884-5. Also stigmatically affected areas do not conform or correspond to those of nerve trunk distributions.¹²

Let us first review the objective of our own recent literature^{37,1} setting forth that *hyperesthesia* is expressive of a tensional, a tetanic form of typical contractile reaction, resultant of low density of tissue, from any cause producing such a loss of tissue integrity, and that *anesthesia* is just as typical a resultant of tissue constricting spasms, of which hyperesthesia is the specific predisposing cause. However, purely psychic hyperesthesia and anesthesia may appear to be, and even as we shall observe, however fluctuating they are, from emotion and psychic causes, the fundamental basis is no less physical and no less dependent upon a physical substratum.

In a recent paper^{37,1} we have introduced evidence that in the more severe (fatal) shell shock cases, congestions, ecchymoses, punctiform hemorrhages, softening of tissue environmental of superficial blood vessels of the brain and contiguous nervous structures are found. We may find similar anatomical states among wet brained alcoholics and among cerebral softenings of general paralysis, but otherwise not at all among the great group of non-traumatic hystericals. We hold that shell shock and

allied traumatisms damage the integrity of the body tissues in general, and thus disorder the mental functions which we hold does not proceed exclusively from the brain or nervous system. Our evidence shows circulatory deflections which could alone account for the tissue softening and attained impermeability to blood in the delicate brain tissues which require for their physical and functional maintenance one-fifth of the blood of the body. As we shall see presently, the effects of *suboxidation* of gas toxemia, of acidosis, etc., and of *suboxygenation*, respiratory, anemic, circulatory, etc., produce general tissue softening. These are the factors that universally obtain, wherever these results occur. Whether traumatic or not, the typical "neurotic" manifestations also find expression. The more severe traumatic types differ in degree rather than in kind. All are physical, but none is specifically nervous. All are both mental and physical. They are indivisible into either one or the other.

Predisposition.—Psychiatrists universally recognize a general predisposing cause of neuroses, whether hereditary or acquired. What that causative factor is has never been identified, much less agreed upon. The pure psychicalists must regard it as psychical, while with the physicalists it must be regarded as physical; yet with both it has ever been an enigma. By virtue of the effect of this inherent predisposition those affected by it are predestined to succumb to all manner of recoil producing factors, from which those uninfluenced by it escape; and the more violent factors from which none escape entirely, the predisposed suffering much more violent reactions than the others. With them the reaction is both precocious and excessive.

The essential character of reaction of the neu-

rotically predisposed is typically spasmodic and paroxysmal, owing to which its victims are not only disposed to emotions and the other neurotic stigmata, but also to the more undisputed purely physical phenomena such as neuralgias, myalgias, asthma, etc., of the older writers, and now since we know that neuralgia, no less than neurosis, is a misnomer, we recognize dermalgias, coxalgias, myosalgias, arthralgias, cephalgias, nephralgias, cystalgias, coelialgias, thoracalgias, pleuralgias, hysteralgias, etc., more accurately named in reference to anatomic involvements; all characterized by spasmodic and paroxysmal pains and due to acute cramp like contractions of the involved tissues.

The physical nature of spasms and paroxysms has never to our knowledge been questioned, but Charcot and his pupils (originally entirely subscribed to by Sollier and others who have since deflected from it) so far as we know, concluded that all hysterical and allied manifestations have a purely *psychic* origin as evidenced by the following data: (1) Absence of any typically related lesions of nerves, cord, or brain, and of atypical areas of involvement as regards conformity to nerve trunk distributions. (2) In the absence of *nerve* sources of causation, hysterical paralyses and contractures must be of *psychic* origin. (3) All hysterical manifestations are artificially produceable by suggestion in sensitive subjects. (4) The anesthesia of hysteria is an *absent-mindedness* and is due to psychological disaggregation and is not always a genuine tissue anesthesia. (5) Arousing of the attention may momentarily hold the anesthesia in abeyance. (6) Genuine anesthetics are usually due to nerve lesions, whereas hysterical anesthetics are especially characterized by mobility. (7) Anesthesia of hys-

teria is extremely changeable and contradictory. (8) All hysterical events are dissoluble by chemical anesthesia. (9) Hystericals are in a permanent state of psychic fatigue. (10) Hysteria is a contradictory disease, and collectively is essentially *psychical* as distinguished from the *physical*, which is treated as of the nervous system if at all, but leaves the biologic factors out of account. Let us recall here that Sollier now defines the war neuroses (cerebral commotions), as hysterias in the raw, as elementary hysterias in which the physical as distinguished from the psychical element, is absolutely preponderant.

Taking up this series of statements of evidence in the order above enunciated, the first and second have been answered by our biological accounting for what the psychical theorists reasoned must be either psychic or nervous in origin, entirely disregarding fundamental irritability and its response recoils; (3) Suggestion, like all sensorial impressions, is reacted to by subjectively related tissues, therefore the reaction is generally physical rather than specifically psychical yet not nervous; (4) however complete or incomplete the hyperesthesias that are exhibited, admittedly they are the physical causes of the abolition of memory, which again is admitted as responsible for amnesia. The fact that anesthesia of the contractile tissues of the body inhibits memory involving the original functional participation in that of which the memory is the recurrence by those tissues, implies that memory is not an independent or exclusive brain function, but a functional product of general tissue reaction which may be subject to a reactionary revivification. In the treatment of amnesia and other diseases of memory the true seat of mem-

ory should be recognized regardless of any soul seat sentiments; (5) distraction is a form of suggestion, and suggestion is a recognized form of influence of contractile phenomena as well as of psychical; (6) loss of general tissue functional integrity and of density accounts for this observed mobility better than any known psychic factors. (7) The instability and fluctuation of tissue spasms explain the changeability and the elusiveness of hysterical anesthesia better than otherwise unexplained psychic caprice. (8) Artificial anesthesia admittedly acts upon tissue but we have no evidence of a separate action on mind. (9) We have no evidence of mental or nervous fatigue apart from associated contractile reactions of tissues. We have here pointed out the general relation between anesthesia and fatigue. Recognizing attention as a tension, as a state of intensive sustained effort, we can understand that momentarily eliciting the attention would necessarily transiently arouse a subject from an incomplete, even a drug narcosis. (10) is answered by answers to (6) and (7).

Fixed ideas of the hysterical series of stigmata, constitute a form of tetany, a mental catalepsy, and in terms of contractility, a rigidity or contracture of involved tissues. In this relation the idea is abruptly acquired as a spasm and is retained as a tetany. The *conviction* of Jastrow¹⁴ is the *fixed idea* of Carpenter⁶, Charcot⁷, Janet¹³ and others. In the words of Jastrow: "There can be no question where beginnings lie. The original source of conviction is emotion. . . . The initial factor in the genesis of conviction is the rivalry between reason and emotion. . . . The design deviates, the workmanship is irregular, as thinking is emotionalized. The wish is father of the thought and breeds true. Dog-

ma and formula, formidable words, like popular slogans help to carry conviction, they are more apt to contribute to obvious fallacy and pretence than to subtle error, but they play their part variously.

Conviction, the snapshot, the immature grasp at an idea, is exhibited in inverse ratio to reason which is the product of mental elaboration, *i.e.* of an extended deliberation. Ideas derived by spasm are those which are prone to persist as fixed ideas. Fixed ideas are thus common to the recoil spasm of shell shock.

Decision by Paroxysm.—There are obviously at least two ways of arriving at a decision, by process of reason, *viz*, by weighing the pros and cons of available evidence and by spasm or paroxysm. By process of producing the sudden emotion of fright, an individual may spasmodically in connection therewith arrive at the conclusion that an impossible dogmatic belief is truth or superior to truth. A fixed idea is as persistent as the underlying hyperesthesia.

The greater the abruptness, haste, stress, dynamic violence of a decision, the moment it is adduced by passion, the greater the attendant emotion of fright, anger, rage, etc., and the more spasmodic and less reasonable it is. An emotional decision is always premature and ill advised, and rash are the acts that proceed therefrom. When a decision is arrived at spasmodically it is thus termed *conviction*, it is perpetual as a fixed idea, a belief. The scene and event incident to shell shock is thus perpetuated as a fixed idea. The term conviction, which originally had reference to the resultant of convincing evidence or perhaps of logical argument, has gradually by misuse, evolved from a state of being convinced, to one of being emotionally and spasmodically trans-

fixed, obsessed (brought to an abrupt decision), attained as by a sudden muscular cramp. The transition is one from a gradually elaborated, to a sudden mental process, and as such, from a constructive mentation to a destructive annihilation or extinction of deliberation. We have in hypnotic processes the best analogy of artificial production of those fixed ideas which are dictated or arbitrarily commanded by another, in either a waking or sleep state. Suggestion acts as a shock.

It is precisely the spasmodic nature of the process of attainment of fixed ideas that makes its cause simultaneously productive of an anesthesia of areas involved in the volitional events of daily life, in the abolishment of memory of those events, and the muscular processes involved in them. In turn, the abeyance of memory in the mechanics of these processes constitutes the basis of the syndrome of amnesia. Whereas fixed ideas are not infrequent accompaniments of amnesia, the latter by no means universally accompanies the former. They represent variations of effect from the same causes.

Fixed ideas are also typical of ecstatic states, and we have been taught to regard the involved thoughts as very high in that state which have undoubtedly misled many from a theory such as we have advanced. Janet, however, disagrees with them when he observes (p 391): "M. Briquet spoke of the 'serious thoughts' which provoke ecstasy. This is because he had perhaps not been able to determine the nature of these thoughts. We much fear that many ecstasies among the most revered, have never thought of anything higher than the monotonous interrogations of Marcelle or Maria."

It is quite universally recognized that ecstasy and emotion produce or coincide with anesthesia, abey-

ance of memory, and of reason, and it is quite obvious that with the obliteration of memory from current mental synthesis, with the usual substitution of subconscious groups, the quality of the product would be low. Even in cases where complete amnesia is not developed, it is well known in police circles that following the great emotion which is incident to accidents and exciting escapades, that individuals are woefully deficient in memory of the details of the incidents of which they were the participants. In these cases confusion of attention, as well as sense anesthesia, is exhibited.

The fixed idea is a prime menace to recovery from shell shock and the depressing emotions of war. It is the essential element that disposes to relapse when new experiences recall memories of original occurrences and distressing scenes. The eradication of the fixed idea is one of the great services which hypnosis has rendered to war victims. It is thus eliminated from the subconscious ensemble of memories, in many cases having long previously been dropped from conscious memory, at the outset of the amnesia.

We do not advocate dispensing with hypnosis where it is of value in behalf of the war's afflicted. We simply deprecate it as an exclusive dependence as based on the view that the war neuroses are exclusively psychical and do not require physical treatment. In properly selected cases hypnosis has no equal and in some cases it has no possible substitute at all. It is hypnosis or neglect. It should, however, always be administered with the patient's written consent, and always in the presence of dependable witnesses, yet utilized when the subconscious and forgotten engrams which amnesia has removed from conscious memory must be reached and restored to

normal consciousness. Many of these cases can be reached by psychoanalysis.

The Biologic Series.—The biologic series is a term we have coined to facilitate economy of expression in referring to that very familiar biologic series of reaction manifestations which always occur in definite sequence and order as typical response phenomena of living tissues. This term is used as regards the definite order of reaction characteristics which are typical of definite phases of tissue density, both as contractile and as sensory reactions. The sensorial application we will defer until that subject is arrived at in the regular course of the paper.

We may excite the several phases of the series, in their natural order as contractile phenomena. If, beginning with a normal state of rest, an excised living muscle be mildly stimulated, preferably by electricity, the first observed response is a simple tightening of the fibers. They are put in a state of tension, as it were, and such a tension can be maintained without producing a perceptible shortening of the muscle until exhaustion flaccidity occurs.

The next step is producible by a slightly increased perturbation, in which the response contraction is incomplete, giving it a twitching character. The next, following a sufficient excitation, is a complete contraction. These phases which may be regarded as ascending reaction types, and may be varied in time relation by the time duration of the stimulus, represent the ascent from the state of rest to the contractile climax. If we continue a sufficient stimulus to maintain a continuous and unremitting (or tonic) contraction, we observe after a variable time, depending upon the vitality of the muscle, that the integrity of the contraction begins to break and a

manifestation of broken integrity of contraction as a descending curve from the climax, thus occupies a transition stage extending to final exhaustion relaxation and flaccidity. The hysterical epileptoid and *grand mal* of complete epileptic paroxysms represent a passing through an analogous series of successive reaction phases. An emotion follows a similar course, a miniature of the major paroxysms, developing tensions of greater or lesser degree, but aborted by precocious overflows or emissions. The hysterical paroxysms, their catalepsies, contractures, constrictions, etc., represent yet more complete contractile phenomena, and the painful contractions, the various paroxysmal affections, asthma, etc., and the acute *algias* characterize the climax stages. Thence succeed clonic contractions and exhaustion flaccidity.

Convenience of consideration and comprehension of these physical states is greatly facilitated by assuming hypothetical phases of tissue reaction, in the order of the biological series as the tissue density reaction equivalents of various definite manifestations, such for example as the progressive hyperesthetic reactions, respectively, of tetany, twitching, tics, catalepsies, contractures, clonic convulsions, flaccid paralyses, etc. We can then better understand the action of the various therapeutic measures at our command, and that those that change the pathological phase should be differentiated into those that restore the normal tissue synthetic processes, the density and the integrity necessary to functional capacity, on the one hand, and those which by toxicity or other agencies carry it forward to the exhaustion stage. The former is physiologically progressive. The latter is one of pathological retrogression. Though they are equally efficient in eradicat-

ing disagreeable symptoms, the ultimate resultant of the former is good, the latter, bad. In the treatment of shell shock, not infrequently symptoms are transiently eradicated by measures such as chemical anesthesia, which do not eradicate the underlying hyperesthesia, and even predispose to relapse when the victim experiences a subsequent shock. Ultimate reflections on these points is sure to bring severe condemnation on those who are responsible for such shortsightedness.

The typical emotion paroxysm, which may be but a miniature of the developed hysterical paroxysm, may range from a simple disturbance of the respiratory rhythm by a prolongation of the inspirations, to even treble that of the expirations. It may be attended by a sobbing form of breathing and accompanied by successions of waves of emission of kinetic energy expressed in ripples of miniature muscular contractions, passive, involuntary, largely insensible to the subject, and affecting mostly the smaller muscles and those of expression more than of posture or movement, ranging to conversion or hysteric types and to motor discoordinations. See Darwin and Bell later on.

Next to emotion, the choreic reaction exhibiting the biological phase of twitching, or incomplete muscular reactions, is expressive of reactions modified by weakness. It is truly an irritable weakness of the soft tissues of childhood, which may be so hyperesthetic that muscular repose is impossible and superirritability agitation is the inciter of involuntary incoordinate movements. Here we observe energy accrument beyond that of the early emission of the emotions, but less than that of the complete tonic contractions. Chorea exhibits movements which in discoordination of movement re-

semble those of the adult amnesia. Tremor exhibited either in sustained effort or motor activity is to be recognized as a weak and imperfect exercise of the muscular organs.

All the specific types of vital reactions exhibit a succession of dominant phases in the biological series, followed by relaxation attended by an exhaustion relative to the expenditure of energy. Emotions vary greatly; the passive pleasant emotions are hardly more than thrills of passing waves of mildly excited sterile impulses. Those of the passive perceptions of music, dramatic performances, speed exploits of airplane and automobile, are those in which the auditor and passenger play an entirely passive part. Here is especially observed an instance where the emotive or amotive feature would be eliminated if the mechanical work of expression or propulsion necessary had to be supplied by the auditor or passenger. These pleasant emotions are accompanied by those transports of delight and of sensorial lulling which are akin to those of religious ecstasy and certain lesser degrees of drug narcosis, of alcoholic intoxication, and chemical anesthesia, all of which are pleasing and captivating, analogous to the passive stimulations of massage.

The distinguishing feature between the so-called *conversion* hysterias and simple emotions, is the contrast between the more or less imperfect physical expression in the former, and the sterility of the latter. All kinds of impulsive and explosive acts are characterized as emotional when really hysterical would be a more distinctive term. They belong to the conversion type of hysterias. The term emotion should be restricted to the less motor and the more emissive and sterile types.

The recoil, or unpleasant emotion, follows more

perfectly the characters of reaction irritability. The emotional addict being in a state of low energy cumulative capacity, the emotion as a recoil phenomenon begins in the biological phase of the persistent state of tension which may develop into a tetany; examples of which are dry grief, restrained rage, tetanic fear, etc., which exhibit delayed relaxations and accrued ultimate outburst force. The more typical emotion, however, is the type which is characterized by little development of tension, and which is being continually released by waves of emission of escaping physical forces. Emotion may emerge into hysterical paroxysm as physical motive forces accrue to explosive outburst.

Every normal individual unconsciously experiences a continuous succession of recoils to his environmental vicissitudes, which, though more or less wearing upon the vitality during waking hours, do not arrest the attention or cause conscious fatigue. If, however, the individual becomes hyperesthetic, these same series of recoils, formerly entirely unnoticed, now become exaggerated and a source of perturbation of conscious irritation and chronic fatigue. If, on the other hand, a mild narcosis or anesthesia or an ecstatic state be substituted, the release from what has been an unperceived factor is now characterized by an indescribable feeling of relief, of freedom, and a mysterious emancipation which is attended with a physical sense of buoyancy, lightness, and relaxation, and a mental one of peace, serenity, blissful comfort, rapturous delight, or transports of felicitous pleasure. As this passes away the previous insensuous perturbations become perceptible.

In other words, the state of lulled sensibilities is one of imperturbation from environmental fac-

tors. Not until one has experienced narcosis or anesthesia, which oblivate the subject from the normally imperceptible factors, does he become conscious of their existence. It is then to some degree, by contrast with the anesthetic abeyance of sensibility, that it is apprehended, though the toxic features of the drugs must also be recognized. However, the typical after event is a heightened acuity of sensation.

A Biological Substratum.—So many cases have been reported wherein soldiers have experienced serious results from a second or third shell shock which were out of all proportion to the current shock, that interest attaches to the underlying cause. After discounting the factors of aggravated irritability, augmentation of the exciting cause, superimposition of one causative factor upon another, increased fatigue and weakness, etc., should cause us to give heed to the biological factors of causation.

In biological research on elementary reactions of rudimentary forms of life, involving the fundamental property of irritability of living substance in general, it is observed that if the excised living muscle, in a state of rest or quiescence, be irritated or stimulated, and after an interval reirritated or stimulated, the same in kind and degree, whereas the first stimulus excites no appreciable reactions the second one will excite one, both precocious and relatively violent. The first reaction, in fact, falls below the physiological unit, *the threshold of stimulation*, and the second greatly exceeds it. The first stimulus sensitizes the object of observation sufficiently to produce a hyperesthesia. This fundamental biological factor should not be ignored in our analytical efforts in behalf of elucidating the many seeming paradoxes of the war neuroses.

If instead of occasional intervalled perturbations a reasonable succession of perturbations occur, the above-mentioned result will not materialize, but instead an immunity will be developed, protective in its nature. Again, if the succession of perturbations be so rapid or frequent that the reaction of one cannot be completed before the accession of the succeeding one a state of coalescent contraction supervenes, termed biological tetanus.

Recurring now to the battle line, we find the first described type among the victims of occasional big-shell explosions; we observe the second type among those of the more frequent ordinary field-gun fire; becoming accustomed to it, we attain a degree of immunity which minimizes the effects of the explosions of close proximity when they occur, which are often referred to as paradoxically inconsequential. If, however, the firing assume the high frequency known as drum fire, the most unhappy results obtain.

It is well known to embryologists that fertilized eggs, subjected to the vibratory jars and shocks of railroad shipping, when later hatched exhibit a delayed development. In many it is completely arrested. The coarse vibrations of electricity prove fatal, whereas the same voltage in very high frequency currents is withstood with impunity. The living substance thus appears to be vulnerable to coarse vibratory perturbations of extended wave length, on the one hand, and of overlapping and coalescing ones on the other. Drum fire has been much observed as a prime factor of shell shock etiology.

Suboxygenation and Suboxidation Factors.—There are many occurrences connected with its occurrence that point in no uncertain way to the con-

clusion that suboxygenation and suboxidation play a prominent part in the production of the composite syndrome of war shock. Primarily, let us recount the three prime essentials of all oxidation, namely: *Oxygenation* (the supply of oxygen), a definite alkaline reserve or *alkalinity*, and a radioactive activation to chemical action at a relatively lower temperature than otherwise would be the case, termed *catalysis*. On oxidation collectively is fundamentally dependent the process of tissue synthesis.

Physiological catalysis is provided by the cell nuclei of the stationary tissues and by a highly nucleonic substance, viz., lecithin, of the circulatory tissues. A supposed poverty of these tissues, or of their phosphoric content in neuroses and psychoses, especially the former, has led to the well-known phosphorus form of internal medicine in this class of cases, and to many artificial catalytic substitutes in the form of radioactive and allied therapeutic measures. We learn from Hamberger's law that phosphates and albumins are given up altogether as cleavage products of the blood when it is even slightly acidulated, or carbondioxide is passed through it. General acidosis is already well proved to be a product of shell shock and a constituent of its syndromes, by competent investigators, recently reviewed by us, and it now remains to point out the *suboxygenation factors*.

As a beginning, let us concede that all cases of peripheral and extremity anemia and asphyxia and splanchnic venous stasis are conditions of marked local and general suboxidation, whether occurring with emotions, hysterical paroxysms, or war shock. Fatigue, as a predisposing cause, we know may produce albuminuria and phosphaturia, and fatigue products in excess produce general toxemia. Physi-

cal exhaustion depresses both the respirations and circulation.

The collective physical phenomena attendant upon near-by explosions of large high-power shells are almost without exception suboxygenational or sub-oxidational in action upon animal life, if the men who have made the subject a scientific study throughout the progress of the war are not discredited. There are too many creditable eye-witnesses to discredit them, whatever be our interpretations. They will ultimately demand a hearing.

The atmospheric disturbance may be perceived from Col. Sir John Collie's statement^s that a high explosive exerts a pressure of ten tons to the square inch. Major Frederick W. Mott²⁰ comments that *enormous aerial compression is generated, the ordinarily incompressible and hence protective character of the cerebrospinal fluid is altered, and it is therefore probable that the compression is transmitted to the fluid about the base of the brain, causing shock, affecting the floor of the fourth ventricle, and resulting in abrupt arrest of the cardiac and respiratory functions*, which is significant, though highly speculative as to the nervous mechanism.

Major Mott,²⁰ ^A after crediting Sydenham with the statement that the forces generated are sufficient to cause instant death, and another's estimate that the sudden atmospheric depression of such cases corresponds to a dynamic pressure of about ten tons to the square yard, comments: "One effect of this is to liberate nitrogen suspended in the blood and transform it into bubbles of gas, which are driven into the capillary vessels and cause instant death." This effect is distinctly deoxygenative.

In his Lettsomian Lecture No. 2, Major Mott re-

marks: "Many of the symptoms of CO poisoning are similar to those which I have observed in shell shock and burial." In his lecture No. 1 he mentions that one may be buried and partly asphyxiated, or suffer from deoxygenation of the blood through CO poisoning, of which high explosives contain so large a quantity.

Returning to lecture No. 2, he continues: "The symptoms of CO poisoning are headache, which may take the form of distention of the head without pain, ringing of the ears, interference with vision, which may become indistinct and blurred, hallucination of sight, and even blindness, giddiness, especially on exertion, powerlessness, yawning, weariness, often vomiting, shivering and feeling of cold, palpitation of the heart, and feeling oppression in the chest. When men regain consciousness they appear dazed and stupid, and generally have no recollection of what has happened," etc.

Proper facilities for prompt artificial oxygenation of badly asphyxiated cases should be convenient directly behind the battle lines, and not only by inhalation, but in comatose cases by gas pumps, through colon tubes per rectum. Many cases can be saved in this way that otherwise would be partially or wholly lost.

A very important derangement of the mind in CO poisoning is loss of memory. This may be characterized by intense retrograde amnesia, together with loss of recognition. Sometimes a whole period of time is effaced from the mind. The power of speech may be lost for some time, or it may come back after many days. This symptom amnesia is as typical a resultant in other cases involving other types of suboxygenation and acidosis.

Major Mott's résumé of the effects of high ex-

plosives: "(1) Commotion from aerial compression, (2) concussion, with or without burial, (3) decompression, with embolism by bubbles of N and CO, (4) inspiration of CO during the aerial compression, (5) prolonged inhalation of noxious gases while lying unconscious or partially buried.

Mott quotes Leonard Hill: "Explosion of a big shell in a trench, dugout, cellar, or other confined place, must, I think, instantly deoxygenate the air and produce a high concentration of nitrogen." This is again deoxygenation to the victim.

The importance of burial as a factor of suboxygenation is emphasized by reports such as one made by Dr. McCurdy¹⁷ of a British soldier who one night was buried, and was under the earth for three-quarters of an hour. The immediate and later symptoms of this case were described as of a most serious nature.

Feiling¹¹ reported a case of a bandman who was buried in a trench for probably twelve hours before being dug out, whose amnesia (loss of memory) was so complete that he was oblivious of his past life, home, family, friends, etc., which, however, were preserved in the subconsciousness which he gave outward expression to under hypnosis, thus exhibiting a double personality, each one oblivious of the other. No CO poisoning was reported in this case.

Sollier and Chartier,³⁶ among the other clinical analogies of shell shock, which vary as to cause only, also recognize caisson disease as a sort of counterpart of its mechanism. The sphere of influence in cases of shell shock is divided into three zones by these authors. In the first the subject experiences a blow proceeding from the displaced air, and of such violence as to be comparable to a

blow from a solid projected with great force. The sequence in this zone is generally fatal, from gross injuries, fractures, dislocations, cerebral and medullary lesions, organic injuries, etc. In the second zone a primary great atmospheric compression, characterized by sudden increase in its density, is followed by a secondary event, a violent atmospheric expansion (decompression) caused by the vacuum produced by the explosion. Gas embolisms are attributed to the expansion phase, and by analogy with caisson disease, cases of hemorrhage, rupture of the ear drum, labyrinthine ear shock, retinal hemorrhage with choroid rupture, paraplegias and hemiplegias are also charged to this, which is also the injurious phase of caisson disease. In the third zone the body is subjected to rapidly decreasing vibrations compared to electric vibratory phenomena, and comparable to electric shock and stroke by lightning.

The authors put the question: May not paralysis, contracture, tremor, anesthesia, etc., be due to inhibition, or to exhaustion caused by excessive stimulation of the sense organs or nervous system, or to a molecular disturbance of some kind produced by vibration in the equilibrium of the nerve cells? Let us add: Is not this inhibition one of spasmodic anesthesia? Are they not physical—contractile?

We will quote the translator's and author's résumés: "In cases of shell shock, then, are present from the outset nervous disturbances of a purely functional aspect, to which may or may not be added organic lesions, generally temporary. At the end of a certain time the same symptoms are formed that belong, in the large majority of cases, to hysteria. The authors believe that this hysterical phase is not a distinct element, nor a superim-

posed condition, but that there exists in these cases a scale of operating factors, physical, mechanical, organic, and psychic, all tending to produce a single clinical result. In the hysteria of shell shock, physical causes and conditions predominate; in ordinary hystero-traumatism, psychological and physical phenomena are on almost the same plane; and in ordinary hysteria the psychological element tends to assume a dominating importance.

As to prognosis, it must always be attended with great reservation and circumspection.

As to treatment, as soon as the organic disturbances disappear the problem is simply one of traumatic neuroses, lacking the psychic element.

The authors draw the following conclusions:

1. The kind of explosion determines the number and variation of its results.

2. The clinical manifestations resulting do not present a definite character, for they are found under other conditions. There is, therefore, no syndrome peculiar to shell shock alone.

3. Some of these manifestations appear to be due to distinctly organic disturbances, others to dynamic disturbances of the central nervous system. The former seem to be caused by the shock and the violent atmospheric expansion, the second by atmospheric vibration.

4. Between the clinical syndromes of a purely organic nature and the functional manifestations exists a series of transitional forms, which fact leads to the conclusion that the central nervous system is subject, with a different degree of intensity, to both types of symptoms.

5. The nervous symptoms of the functional type are found most often, from the somatic point of

view, with the characteristics usually attributed to hysteria, as described by Charcot.

6. These symptoms exhibit hysteria in its most spontaneous and elementary form, lacking absolutely the psychological complex that ordinarily complicated and colors it.

7. They prove that hysteria can be of a purely physical origin, without the interpolation of any psychological process whatever, conscious or subconscious.

8. Psychological theories of hysteria are, therefore, insufficient for explaining all cases. Only a physiological interpretation is applicable to hysteria from a physical cause as to hysteria from a mental or moral cause."

As opposed to the able observations and analyses of Sollier, Babinsky² differentiates all so-called functional disorders into two varieties: those which are readily cured by psycho-therapy, and those in which he thinks the patient is opposing recovery. He questions whether those not curable by psycho-therapy should not be refused discharge or sick leave. It is obvious that such narrow considerations as these lead to much harm. Not that discharge and sick leave are desirable, but rather the implied suggestion that unless cured by psychotherapy (since he recognizes no organic or physical damage), the patient must be a malingerer or a disloyal resister of recovery. In contrast with this, Sollier recognizes the existence of a *fixed idea* of incurability on the part of the patient, which he makes a subject of treatment and cure. It would seem an injustice to the patient, and the physician should not be too prompt in bringing him under suspicion before he has exhausted therapeutic possibilities outside of his own convictions (fixed

ideas). Where optimism is high, when offensive is successful, much can be disregarded, but protracted trench warfare in winter makes it unsafe.

The Fatigue Factor.—The fatigue factor of the war neuroses is by no means an insignificant one. It calls for individual consideration, notwithstanding that its etiologic factors are by no means entirely separate from the other causes elsewhere treated. Farrar¹⁰ has commendably retrospected the monographs of Bonhoffer,³⁸ Buzzard,³⁹ and Maitland⁴⁰ on fatigue and other factors of exhaustion, and exhaustion neuroses and psychoses.

The premonitory signs, such as irritable weakness, restlessness, insomnia, debility of attention, emotional instability, depression, etc., indicate hyperesthesia involvement with beginning exhaustion. Optic and auditory hallucinations exhibit superacuity of hyperesthetic reaction. The increased instability of muscle and the mild neurotic symptoms, arterial sclerosis, etc., suggest chemical irritations and mild inflammatory reaction; such as accumulated acid products, would be prone to cause. The extreme pallor, low blood pressure, edema of lower extremities, somnolence, collapse, etc., suggest splanchnic venous stasis; and the dilatation of the heart, emaciation, diffuse muscular atrophy, edemas, chronic phlegmons, susceptibility to tuberculosis and other parasitic diseases, exhibit advanced inhibition of tissue synthesis, with serious loss of tissue density, and of functional and resistance integrity.

The conspicuous feature of these cases is the persistence and permanence of the fatigue sequences. Such extremes are little seen, apart from the rigors and disciplined overfatigue and exhaustions of war. Recuperation following excessive

fatigues and exhaustions is painfully slow, especially following collapse. If these cases be returned to the line without rest and recuperation, often of many months, relapse is prompt, and exposure to shell explosions is quickly followed by shell shock and greatly augmented incapacitations.

A great danger in these cases is the exhibited proclivity of medical men to be overimpressed by the so-called psychical factors of causation, such as the withstanding of unremitting bombardment, especially of "drum fire," and moreover the resultant exhibition of emotional instability, insomnia, hysteria, and other classical "neurotic" and psychical manifestations, and finally of exhaustion psychoses, tends to warrant the conclusion that the syndrome is essentially psychical, perhaps imaginary or simulative. This great injustice has been done to this class of cases by medical men of all the belligerent nations, by both omission and commission. In the latter Germany leads, but the manner of their treatment of the deported Serbians out-Turks the Turk in barbarity.

It should be emphasized that it is economically best, as far as possible, to keep within the fatigue limitations of troops. Germany has recently given us evidence that exhausted troops are poor fighters, Russia did the same in the Russo-Japanese war. When fatigue limits have to be exceeded, not only ample rest should be enjoined, but resulting acidosis should be promptly neutralized by sodium bicarbonate, and the faltering circulation should be activated by hot coffee or other stimulants; but food should not be allowed too generously until the fatigue crisis has passed. All suspicious cases of cardiac dilatation and venous stasis should be removed from the ranks and treated with ergot until

on reexamination they are shown to be equal to any service assigned to them.

The fatigues and exhaustions of continuous physical recoils, tensions, strains, tetanies, etc., are those of the physical body, contractile in nature, and accompanied with accumulation of the excrementitious metabolic products which we term fatigue products. The nervous tissues are probably least concerned in them of any in the body. These toxic excrementitious products react upon the living tissues, and as poisons retard the synthetic processes, resulting in a lower grade of tissue integrity, which is exhibited by lower density of the solid tissues and by lower specific gravity of the blood.

Fatigue plays so conspicuous a part as an acquired predisposing factor that some writers emphasize the collective events of war which eventually exhaust or render the subject prone to shell shock, under the general term strain. Smith and Pear² regard "war strain" as a more satisfactory term for the whole syndrome than shell shock. The use of the word strain implies continued perturbations, and anxieties culminating in some sort of giving way or outbreak, as a cumulative effect, which in war is greatly multiplied. Strain expresses the stress experienced in a monotonous highly disciplined life which is attended by the withstanding of incessant firing, which highly excites, with all responsive reaction, restrained or inhibited, until a contiguous shell burst affords the impetus to an explosive outburst of pent-up emotions. This factor should not be ignored, though it by no means constitutes the entire syndrome as our collective data show.

As producers of polyuria, the superstress of sustained mental effort, the strain of sustained motor

effort, the stress of the mental strain of bombardment, the anxiety of apprehension and dread, the tetany of worry and the tensional depression status, are about equal. However usually recognized as diversely psychic and physical states, they are all causes of polyuria and of fatigue and exhaustion as well as of psychic symptoms. Fatigue augments the hyperesthesia of the hysterical, and may be the exciting cause of an accident.

As fatigue products accumulate and by their protoplasmic toxicity are productive of hyperesthesia, we observe inversely with the exhibited general superirritability a coincident benumbing of the muscular sense and often of cutaneous sensibility. The relation of this factor should not be ignored when summing up the participation of fatigue in the syndromes of the war neuroses. In hyperesthesia and anesthesia we have a connecting link between the physical and the psychical.

Anesthesia of Exsanguination Asphyxia.—Sensory retrogradation in order of *biologic series*. Anyone can prove to himself the fact that tissue asphyxia is productive of anesthesia, by the highly artificial process known as distilled water anesthesia, by virtue of hypodermic injections of distilled water into a circumscribed zone until it is completely distended with the water, producing pressure displacement of the capillary blood, as indexed by blanching of the area. This anesthesia is as complete as though an adequate solution of cocaine was used. It may be added also that general anesthesia is producible by respiratory asphyxia, though it is accompanied by loss of consciousness. Most individuals are however familiar with the production of anesthesia below the knee of the leg crossing over the other, in which the patella of the

under leg makes pressure against the vessels underlying the uppermost leg. Clinical observation provides numerous instances of anesthesia of exsanguinated extremities, and localized and generalized anemia of the periphery. One of these is by the circulatory stasis of an esmarch bandage.

Partial mechanical anemia, however does not in direct ratio produce a partial anemia, unless it is very gradually produced. When at all abruptly mechanically produced, circulatory anemia is attended by a too paroxysmal type of contractile reaction. If well graduated, it is characterized primarily by tension and hyperesthesia, secondarily by twitching and paresthesia, thirdly by cramp (spasmodic tonic contraction) and dysesthesia or pain, fourthly by broken or clonic contraction or convulsions and partial anesthesia, and finally by exhaustion relaxation, flaccid paralysis and complete anesthesia. Between these five phases of a curve of the range from the normal to flaccidity and anesthesia, one may fill in all transitional gradations intervening them, thus completing an orderly series of vital reaction events common to all reaction of living parachymatous tissues and owing to which fact we have dubbed it the curve of the *biologic series*.

Tissue density, as an index of the existing degree of integration and physical integrity of the tissues, other factors equal, occurs in direct ratio to its blood supply. Every individual exhibits a state of tissue density which is commensurate with his maintained states of tissue sanguination, qualified by the quality of the blood, and every individual standard of tissue density carries with it a corresponding phase in the *biologic series* as to specific reaction characters. Physical reaction

characters are as typical of unit densities of living tissue as are the physical properties of the chemical elements to their atomic weights.

The relative importance of air, water and food as constituents of the body may be gathered from the time honored physiological maxims: "We can go seconds without air, days without water, and weeks without food." The chemical state of the body finds its prime importance in that degree of alkaline reserve which is necessary to oxidation and other normal chemical reactions. Among others may be mentioned the salt equilibrium, which is so vital that tissue integrity depends upon it, though it also is specifically related to the chemical reaction as shown by Hamberger's law which provides that blood even slightly acidulated gives up albumins and phosphates to the serum, while conversely when alkali is added, chlorides are taken up from the serum by the cells. Moreover, carbon dioxide passed through it acts the same as the acid, and oxygen acts the same as the alkali, the former fostering *disintegration* and the latter *integration*. We may add further that the former lowers tissue density and integrity while the latter fosters them. We observe that asphyxia and acidosis are notable derivatives of the spasmodic procedures from chill, violent emotions, concussion, accidents, war shocks, etc.⁴¹

Numbness results from emotions and anesthesia from yet more marked spasmodic contraction. Thus we observe a wide range of what have long been termed neurotic and hysterical phenomena as ultimate sensory disturbances, varying from the numbness of emotional origin to the anesthesia of spasmodic and paroxysmal contractions. Emotion from the esthesia standpoint shades gradually into

paroxysmal reaction. We can place no mark of demarcation between the two. Emotions lose their typical emotion qualities of reaction as they progress in morbidity and become more chaotic and less defined, as they approach the characters of simple paroxysmal reactions on the one hand, or as they retrograde into simple emissions of energy on the other. In other words as they become sthenic or asthenic of diverse extremes of character.

Hyperesthesia obviously occurs in various degrees, for all exhibited hyperesthesia is not sufficient to produce spasmodic asphyxiate anesthesia. Mott²⁰ observed that hyperesthesia is more common than anesthesia. He found both superficial and deep sensibility affected and in severe cases sometimes loss of sensibility to all forms of stimulus. Myers²³ reports observations of hyperesthesias and resultant over-reactions of increase of effective response. He has observed several cases in which the hyperesthesia has passed over into *hypesthesia* and anesthesia. Like Mott, he observed great variations in sensibility, but saw a preponderance of *hypesthesia* and anesthesia—perhaps at later periods than Mott. These contrary reports lead to the conclusion that the two opposite states are really equal.

“Myers found about two-thirds of the cases of disturbed sensibility were accompanied by spontaneous or subjective disorders of sensation or of movement. Such disorders were often successfully traced to actual blows in the region in question from sandbags or other objects, or to the patient's fall after having been pushed or lifted by the concussion” (Transcript by Brown and Williams⁵). This agrees with observations of Mosso cited in my former paper.³⁷ We regret these vagaries of descrip-

tion, but are glad of the mention of disorders of sensation, however, not understood.

In the idiot, imbecile, hysteric, and the war shock victims, to the extent that normally involved functioning tissues lose sensibility of their own muscular reactions and to exterior sources of impression, we observe exhibited functional incapacity, both physically and mentally. This is most adequately exhibited in those unstable individuals who fluctuate from sensibility to insensibility and exhibit normality during the sensibility periods and corresponding mental and physical disability during the anesthetic periods. Yet, when anesthesia is artificially produced and the pathologic anesthesia is thus eradicated, the primarily abnormal condition becomes normal. This fact proves our postulate that the root of the abnormality is a hyperesthesia and not the more conspicuous anesthesia.

That the exhibited symptomatic anesthesia is the derivative of a spasmodic exsanguination of the affected tissue is shown by the well established fact that when spontaneously occurring, it is a product of those diatheses and stigmata which otherwise are productive of spasmodic and paroxysmal phenomena; moreover when artificially produced, those procedures which obviously promote spasmodic reactions, produce the ultimate effects and conversely such agents as anti-spasmodics, narcotics and anesthetics, instead of increasing the symptomatic anesthetics, anomalously, temporarily or permanently abolish them. In fact the abnormality is eradicated and as far as that abnormality is concerned, *a normal state is produced temporarily by an artificial anesthetic, or by hypnosis, by virtue of relaxing the tetany or paroxysm which was responsible for the primary*

asphyxial anesthesia. Such artificial relaxations occasionally prove permanent and as such, cure of the ailment.

Secondary Tissue Changes.—Among apparent paradoxes presented on both sides of our subject may be mentioned the changes in involved tissues from pre-spasmodic states of low density as predisposing to paroxysmal types of reaction, to post-spasm states of high density, which Roy and Cobbett²⁶ observed in skeletal muscles as due to exsanguination in surgical shock following which a rise in the specific gravity of the blood was ascertained within an hour or two, and to rise so high that it flowed with difficulty except in the largest arteries; the intestinal walls meanwhile losing their density, becoming succulent and passively hyperemic. Complementary to the above mentioned reverse in direction of tissue density change, from the state antecedent, to that succeeding the shock spasm, we know that hyperesthesia proceeds while anesthesia as typically succeeds the outset of this median event. In other words the predisposing status, leading up to the spasmodic reaction, is hyperesthesia, while the ensuing effect as exhibited by those areas affected by the spasm is anesthesia, not infrequently of an asphyxial nature, otherwise partially so.

The next exhibited phase in the order of the *biologic series* is that of full tonic contraction. This may be local or general, transitory or protracted, and either painful or not, corresponding to the acuity of the cramp spasm. In general, the acuity of the contraction and of the pain is synonymous, the greater acuity appearing in the smaller muscles; those of the face and intercostal spaces being notable. The more intensive contrac-

tion is also exhibited in the more vulnerable extremities, such as the muscles of the calf of the leg and the extensors and flexors of the feet which are most subject to painful cramps. The muscles of the extremities, collectively, exhibit hysterical and hypnotic catalepsies, contractures and rigidities, and as tonic phases of hysteric and true *grand mal* epileptic paroxysms, in which it occurs following a tetanic aura largely affecting the thorax, the pharynx and larynx in their deglutition and respiratory functions, erectile swelling of the pharyngeal tonsil. This somatic tonic contraction is succeeded by a phase exhibited by its broken integrity (clonic contraction), which is intermediate in the progressive course traversed to the final goal of exhaustion relaxation, the diffuse collective contraction of the somatic body is seldom if ever painful owing to the diffuse dissemination of the contractile phenomena. The observation that the aura exhibits its perceptible beginning in the weakest organ appears to hold true at least when the weak organ is the stomach. The question of the existence of visceroptosis in the cases where it arises from the abdominal region is an interesting one. Certainly strong emotion and many epileptic auras appear to emanate from stomachs also exhibiting dilation, ptosis, tenderness, and often a sense of soreness.

Pleasurable and painful features of emotions are in fact phases of relaxations and more or less tetanic contractions, as in *feeling* in general, as muscular sense phenomena. Persistent anesthesia of the muscular sense involves a loss of voluntary activity and loss or abeyance of memory of past voluntary use of the motor organs, and involves current incoherence and incoordination. Anesthesia with nullity of muscular sense involves abeyance of memory of its past functional acts.

Ecstasy is perhaps the most elusive of the hysterical crises. It is at once radically physical and radically mental. It has been characterized as the most "spiritual" of all mental phenomena. The ancients, when in ecstatic states, saw visions and prophesied. This state was fostered by fasting until advanced states of anemia and general inanition were attained, and not infrequently it was augmented by free indulgence in wine and the crude forms of oriental narcotics. The typical feature of ecstasy is bodily insensibility and mental revery in which inability to reason and to perform mental tasks is as marked as is the hyperesthesia of the body. A sense of walking on air, while in the waking or semi-waking (walking) state is typical of several other allied states exhibiting loss of sensibility not excepting alcoholic intoxication. Ecstasy is surely not a *material* entity, but it is obviously a *physical* state characterized by abeyance of a vital function, as the effect of pathogenic factors above outlined. The hallucinations, when exhibited, show an advanced pathologic state.

Phenomena such as ecstasy and the emotions appear to occupy a place on the borderline as transitional phases between the purely psychic and the purely motor, partaking at times of both coincidentally, and of each alternately. They are characteristic expressions of instability and of frequent facilitated fluctuations from one extreme to the other, though obviously subnormal and typical of disequilibrium. Owing to this aspect they are in many ways atypical.

Ecstasy in many ways approaches amnesia as a state of loss of sensation, memory and reason though less permanent. Perhaps one of the best arguments against the identity of ecstasy and allied phenomena with purely *psychical* phenomena

is the fact that they act in inverse ratio to one another. Capacity for intellectual tasks diminishes correspondingly as ecstasy progresses. Reason and ecstasy are incompatible, one must decline as the other rises. The development of ecstatic states must be cured before a victim of hysteria can be expected to resume his normal economic capacity. He can be cured by correction of the tissue density and physical contractile derangements that underlie his hyperesthetic and anesthetic states.

The present paper is the second of a series of three on diverse aspects of the War Neuroses. In the third article will be found a recapitulation summary and a bibliography for the second and third papers.

In the third paper the author will endeavor to analyze and interpret individually the several typical manifestations which collectively go to make up the characteristic syndromes met with by the army psychiatrists, as reported by them in the current literature.

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A Practical Medical Dictionary of Words Used in Medicine. With Their Derivation and Pronunciation, Including Dental, Veterinary, Chemical, Botanical, Electrical, Life Insurance and Other Special Terms. By Thomas Lathrop Stedman, M.D. Illustrated

American Practice of Surgery A Complete System of the Science and Art of Surgery by Representative Surgeons of the United States and Canada. Editors: Joseph D. Bryant, M.D., Albert H. Buck, M.D. Complete in Eight Volumes. Profusely Illustrated. Volume VIII.

Surgery of Deformities of the Face—Including Cleft Palate. By John B. Roberts, A. M. M. D. Illustrated with 273 engravings.

SOCIETY REPORTS.

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MEDICAL ITEMS.

Contagious Diseases—Weekly Statement—Health Reports.

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